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Appl. No. 09/516,004

Attorney Docket No.: D8143-00330
Kizilyalli 46-19-123US

OIPE JCISS JAN 21 2005 PATENT & TRADEMARK OFFICE

CANCELLED

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Kizilyalli et al.**

Examiner: Ori Nadav

Serial No.: **09/516,004**

Group Art Unit: 2811

Filed: **02/29/2000**

Confirmation No.: 9672

For: SELECTIVE LASER ANNEAL ON SEMICONDUCTOR MATERIAL

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REPLY BRIEF

Pursuant to 37 CFR 1.193, Appellants hereby submit this reply brief responsive to the Supplemental Examiner's Answer. The Reply Brief is being timely submitted under 37 CFR 1.193, the date of the Supplemental Examiner's Answer being November 17, 2004.

Respectfully submitted,

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I. INTRODUCTION

This Reply Brief is directed only to new arguments made for the first time in the Supplemental Examiner's Answer, and to correct certain inaccuracies in the Supplemental Examiner's Answer.

II. ARGUMENT

A. THE CITED REFERENCE OF YU CLEARLY DOES NOT TEACH SELF-ALIGNED SOURCE AND DRAIN REGIONS

In the Supplemental Examiner's Answer, the Examiner repeatedly alleges that the reference of Yu teaches self-aligned source and drain regions 22, 24. The Examiner states, on page 4, last two lines, "Clearly, gate electrode 18 acts as a mask while implanting or diffusing source and drain regions 22, 24". The Examiner repeats this language on page 6, lines 10-11, on page 9, last two lines. The Examiner also contends, in paragraph 5 that Yu teaches source/drain regions formed after forming the gate electrode.

On the contrary, Yu **does not** teach or even allow for self-aligned source and drain regions. In column 2, line 62-64, Yu recites: "Dopants in regions 22 and 24 and extensions 23 and 25 are preferably activated by a rapid thermal annealing (RTA) <u>before layer 34 is deposited</u>." (emphasis added) Then, in column 6, lines 3-5, Yu teaches "Gate conductor 36 is deposited as a conformal layer over layer 34. Conductors 34 and 36 are dry etched to form the structure in gate structure 18 (FIG. 1)."

Layer 34 is thus part of the gate which is formed <u>after</u> source and drain regions 22 and 24 are formed and activated by RTA. Hence, source/drain regions 22, 24 are <u>not</u> and cannot be, self-aligned to the gate. In fact, Yu recites, in column 5, lines 53-55 "layer 34 is deposited after high-temperature processes (e.g., greater than 800°C) are

completed (e.g., silicidation, dopant activation, etc.)." Yu therefore necessarily teaches source and drain regions that are not self-aligned.

Appellant's invention is distinguished from Yu because the selective annealing process of the subject invention can be carried out after the amorphous insulative layer is formed and the source and drain regions are formed self-aligned with the gate structure, and without changing the high dielectric constant (k>5) characteristic of the amorphous insulative layer.

B. SELF-ALIGNED SOURCE/DRAIN REGIONS ARE DISTINGUISHING STRUCTURAL FEATURES

The Examiner concedes that self-aligned source and drain regions are a distinguishing structural feature. The Examiner states, on page 10, lines 8-10 "claiming a final structure wherein the source and drain regions are self-aligned with the gate structure is structurally different from a device whose final structure does not include source and drain regions self-aligned with the gate structure." The Examiner apparently attempts to characterize the diffusion that occurs during dopant activation as taking away the self-aligned nature of the structure. This is not so.

Self-aligned source and drain regions are distinguishing structural features and enjoy the advantage over non-self-aligned source and drain regions because the self-aligned source and drain regions use an already-formed transistor gate as a mask when forming the source/drain regions in the substrate by way of ion implementation or diffusion. This provides virtually perfect alignment with respect to the gate. This is true before and after any subsequent dopant activation processes are carried out to alter the dopant profile in the substrate. Self-aligned source/drain regions mean just that – not source/drain regions that don't extend under the gate structure after subsequent thermal

processing. When a particular subsequent heat treatment (dopant activation) operation is carried out on any source/drain region, the dopant profile changes in a similar manner for self-aligned or non-self-aligned source/drain regions (i.e. some lateral diffusion may occur) but the self-aligned source/drain regions still enjoy the same advantage that their alignment with respect to the gate electrode is superior to that of a non-self-aligned source and drain structure because they are self-aligned to the gate when formed.

Self-aligned source and drain regions remain self-aligned even when their dopant profiles change. Applicants have never suggested that self-aligned source/drain regions are precluded from extending under the gate structure after subsequent thermal processing has taken place.

C. THE DEVICE ILLUSTRATED IN FIGURES 1 AND 3 OF THE SUBJECT APPLICATION INCLUDES SELF-ALIGNED SOURCE/DRAIN REGIONS

On page 8, lines 9-11, the Examiner states: "The device of figures 1 and 3 clearly does not comprise self-aligned source and drain regions as the subsequent processing steps diffuse the source and drain regions under the gate." As appreciated by one of ordinary skill in the art, figures 1 and 3 merely depict a normal dopant profile of self-aligned source/drain regions after thermal treatment such as dopant activation.

For reasons discussed in Section B above, figures 1 and 3, including the slight overlap portion do indeed illustrate self-aligned source and drain regions. Appellant previously argued that "the self-aligned source and drain regions may include a slight overlap region with the gate as illustrated in Figures 1-3" at page 7, fourth paragraph of the Appeal Brief.

D. FIGURE 5 OF THE SUBJECT APPLICATION ILLUSTRATES A NEW FEATURE IN ADDITION TO REPRESENTING SUBSEQUENT PROCESSING OPERATIONS PERFORMED ON THE STRUCTURE OF FIGURE 3

The Examiner apparently relies upon figure 5 to support his position that self-aligned source and drain regions can become transformed into non-self-aligned source and drain regions. Appellants respectfully submit that this is not the case for reasons set forth above.

Furthermore, Figure 5, relied upon by the Examiner to support a self-aligned source/drain region becoming non-self-aligned – clearly includes features of another exemplary embodiment. While Figure 5 does show aspects of the structure of Figure 3 after subsequent processing has been carried out and as stated in the specification, Appellants again respectfully submit that it is clear to anyone of ordinary skill in the art that the drain extension 62 cannot be subsequently formed onto or below the structure illustrated in Figures 1-3 and that it is inherent that drain extension 62 of Figure 5 additionally illustrates features of a different embodiment than illustrated in Figures 1-3. Upon allowance of the subject application, appellants propose to amend the specification to reflect this. Moreover, subsequent processing operations do not change the advantage and distinction that self-aligned source/drain regions retain with respect to non-self-aligned source/drain regions.

E. THE MERE FACT THAT OFFICIAL NOTICE WAS TAKEN THAT IS CONVENTIONAL TO USE A GATE TO USE SELF-ALIGNED SOURCE AND DRAIN REGIONS DOES NOT MAKE OBVIOUS THE COMBINATION OF THIS FEATURE AND A HIGH (K>5) GATES DIELECTRIC

The Supplemental Examiner's Answer states that "the Examiner took the official notice that it is conventional to use the gate as a mask to form a self-aligned source and

drain region in Yu's device," page 11 lines 13-14 and "Moreover, even appellant states that forming the source/drain region self-aligned with respect to the gate structure is common to current semiconductor processing," lines 19-20. Appellants point out that, while it is conventional and prior art to form self-aligned source/drain regions, the conventional art precluded the use of this feature _in combination_ with the feature of an amorphous insulative layer have the dielectric constant greater than 5, and it is the combination of these features that is claimed. According to the prior art, these features were mutually exclusive.

III. CONCLUSION

In view of the foregoing, reversal of the final rejection and remand to the Examiner with direction to allow claims 6-11 is respectfully solicited.

Respectfully submitted,

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